



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

## NOTICE OF ALLOWANCE AND FEE(S) DUE

7590

10/31/2008

Patrick W Rasche  
Armstrong Teasdale  
Suite 2600  
One Metropolitan Square  
St Louis, MO 63012

EXAMINER

FERNANDEZ, KATHERINE L

ART UNIT

PAPER NUMBER

3768

DATE MAILED: 10/31/2008

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/564,169

07/27/2006

Kagayaki Kuroda

198812

7831

TITLE OF INVENTION: SELF-REFERENCING/BODY MOTION TRACKING NON-INVASIVE INTERNAL TEMPERATURE DISTRIBUTION MEASUREMENT METHOD AND APPARATUS USING MAGNETIC RESONANCE TOMOGRAPHIC IMAGING TECHNIQUE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1510	\$300	\$0	\$1810	02/02/2009

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.**

**THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.**

### HOW TO REPLY TO THIS NOTICE:

#### I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.**

# **PART B - FEE(S) TRANSMITTAL**

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590

10/31/2008

Patrick W Rasche  
Armstrong Teasdale  
Suite 2600  
One Metropolitan Square  
St Louis, MO 63012

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

## **Certificate of Mailing or Transmission**

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/564,169

07/27/2006

Kagayaki Kuroda

198812

7831

TITLE OF INVENTION: SELF-REFERENCING/BODY MOTION TRACKING NON-INVASIVE INTERNAL TEMPERATURE DISTRIBUTION MEASUREMENT METHOD AND APPARATUS USING MAGNETIC RESONANCE TOMOGRAPHIC IMAGING TECHNIQUE

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
-------------	--------------	---------------	---------------------	----------------------	------------------	----------

nonprovisional

NO

\$1510

\$300

\$0

\$1810

02/02/2009

EXAMINER	ART UNIT	CLASS-SUBCLASS
----------	----------	----------------

FERNANDEZ, KATHERINE L

3768

600-412000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

1 \_\_\_\_\_

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

2 \_\_\_\_\_

3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☐ Issue Fee

☐ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s); (Please first reapply any previously paid issue fee shown above)

☐ A check is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number \_\_\_\_\_ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature \_\_\_\_\_

Date \_\_\_\_\_

Typed or printed name \_\_\_\_\_

Registration No. \_\_\_\_\_

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/564,169

07/27/2006

Kagayaki Kuroda

198812

7831

7590

10/31/2008

Patrick W Rasche  
Armstrong Teasdale  
Suite 2600  
One Metropolitan Square  
St Louis, MO 63012

EXAMINER

FERNANDEZ, KATHERINE L

ART UNIT

PAPER NUMBER

3768

DATE MAILED: 10/31/2008

## Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 224 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 224 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

**Notice of Allowability**

Application No.

10/564,169

Applicant(s)

KURODA, KAGAYAKI

Examiner

KATHERINE L. FERNANDEZ

Art Unit

3768

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the Amendment filed on November 21, 2007.
2. ☒ The allowed claim(s) is/are 1-36.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some\* c) ☐ None of the:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
- \* Certified copies not received: \_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).**
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

- |  |   |
|--|---|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892)   | 5. <input type="checkbox"/> Notice of Informal Patent Application                     |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 6. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date ____. |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO/SB/08),<br>Paper No./Mail Date ____     | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment                   |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material | 8. <input type="checkbox"/> Examiner's Statement of Reasons for Allowance             |
|  | 9. <input type="checkbox"/> Other ____.   |

Art Unit: 3768

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Robert Reeser on October 24, 2008.

2. The application has been amended as follows:

Claim 1 has been rewritten as follows:

1. A method for measuring a temperature change during a heating or cooling therapeutic procedure in a region of interest inside an object comprising the steps of:

when a local temperature change takes place in a certain position inside an object, acquiring a measured phase distribution image representing a temperature distribution inside said object using, as a temperature indicator, a phase of complex magnetic resonance signals from water protons inside said object observed by a magnetic resonance tomographic imaging technique;

defining a certain position in said acquired measured phase distribution image as a region of interest;

estimating a phase distribution of complex magnetic resonance signals before a temperature change in said region of interest based on a phase distribution of complex magnetic resonance signals in a portion surrounding said region of interest wherein the surrounding portion is subjected to substantially no temperature change;

acquiring an estimated phase distribution image based on said estimated phase

Art Unit: 3768

distribution;

calculating an amount of phase variation of complex magnetic resonance signals caused by a temperature change in said region of interest by conducting subtraction between said acquired measured phase distribution image and said estimated phase distribution image on a pixel-by-pixel basis; and

measuring an amount of a temperature change in said region of interest based on said amount of variation.

Claim 2 has been amended as follows:

2. A method for measuring a temperature change during a heating or cooling therapeutic procedure in a region of interest inside an object comprising the steps of:

when a local temperature change takes place in a certain position inside an object, acquiring a real-part image and an imaginary-part image as measured complex images incorporating a temperature distribution inside said object using, as a temperature indicator, a phase of complex magnetic resonance signals from water protons inside said object observed by a magnetic resonance tomographic imaging technique;

defining the same position in said acquired real-part and imaginary-part images as a region of interest;

estimating a distribution of a real part and an imaginary part of complex magnetic resonance signals before a temperature change in said region of interest based on a distribution of a real part and an imaginary part of complex magnetic resonance signals

Art Unit: 3768

in a portion surrounding said region of interest wherein the surrounding portion is subjected to substantially no temperature change;

acquiring an estimated complex image based on said estimated real-part and imaginary-part distribution;

calculating an amount of phase variation of complex magnetic resonance signals caused by a temperature change in said region of interest by calculating a phase difference between said measured complex image and said estimated complex image on a pixel-by-pixel basis; and

measuring an amount of a temperature change in said region of interest based on said amount of variation.

Claim 13 has been rewritten as follows:

13. A temperature change measurement apparatus for measuring a temperature change during a heating or cooling therapeutic procedure in a region of interest inside an object comprising:

means [of] for, when a local temperature change takes place in a certain position inside an object, producing a measured phase distribution image representing a temperature distribution of said object using, as a temperature indicator, a phase of complex magnetic resonance signals from water protons inside said object observed by a magnetic resonance tomographic imaging technique;

means [of] for defining a region of interest in said acquired measured phase distribution image;

means [of] for estimating a phase distribution of complex magnetic resonance signals before a temperature change in said region of interest based on a phase distribution of complex magnetic resonance signals in a portion surrounding said region of interest wherein the surrounding portion is subjected to substantially no temperature change;

means [of] for producing an estimated phase distribution image based on said estimated phase distribution;

means [of] for producing a phase difference distribution image from a phase difference in complex magnetic resonance signals caused by a temperature change in said region of interest by conducting subtraction between said acquired measured phase distribution image and said estimated phase distribution image on a pixel-by-pixel basis; and

means [of] for calculating a temperature change from said phase difference distribution image.

Claim 14 has been rewritten as follows:

14. A temperature change measurement apparatus for measuring a temperature change during a heating or cooling therapeutic procedure in a region of interest inside an object comprising:

means [of] for, when a local temperature change takes place in a certain position inside an object, producing a real-part image and an imaginary-part image as measured complex images incorporating a temperature distribution of said object using, as a

Art Unit: 3768

temperature indicator, a phase of complex magnetic resonance signals from water protons inside said object observed by a magnetic resonance tomographic imaging technique;

means [of] for defining a region of interest in said acquired measured complex image;

means [of] for estimating a complex image before a temperature change in said region of interest based on a distribution of a real part and an imaginary part of complex magnetic resonance signals in a portion surrounding said region of interest wherein the surrounding portion is subjected to substantially no temperature change;

means [of] for producing an image representing the amount of phase variation of complex magnetic resonance signals caused by a temperature change in said region of interest by calculating a phase difference between said acquired measured complex image and said estimated complex image on a pixel-by-pixel basis; and

means [of] for calculating a temperature change from said phase distribution image.

In claim 15, in line 2, the word “of” has been deleted and the word – for – inserted therefor.

In claim 16, in line 2, the word “of” has been deleted and the word – for – inserted therefor.

In claim 17, in line 2, the word “of” has been deleted and the word – for – inserted therefor.

Art Unit: 3768

In claim 18, in line 2, the word “of” has been deleted and the word – for – inserted therefor.

In claim 19, in lines 2 and 4, the word “of” has been deleted and the word – for – inserted therefor.

In claim 20, in line 3, the word “of” has been deleted and the word – for – inserted therefor.

In claim 23, in line 2, the word “of” has been deleted and the word – for – inserted therefor.

In claim 31, in lines 2 and 4, the word “of” has been deleted and the word – for – inserted therefor.

In claim 32, in line 2, the word “of” has been deleted and the word – for – inserted therefor.

In claim 35, in line 2, the word “of” has been deleted and the word – for – inserted therefor.

### ***Conclusion***

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KATHERINE L. FERNANDEZ whose telephone number is (571)272-1957. The examiner can normally be reached on 8:30-5, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Brian Casler can be reached on (571) 272-4956. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Eric F Winakur/  
Primary Examiner, Art Unit 3768